

New 2-m Winlink Gateway for Philadelphia Area Hams

An incremental and iterative process results in a working Radio Message Server Winlink Gateway.

In spring 2021 I was building an HF antenna and working on learning the essentials of emergency communication, and was growing increasingly frustrated because I was unable to connect to any Winlink gateway on VHF or HF. Sure, I could send email messages through Winlink using the built-in telnet facility, but the point was to use amateur radio RF to connect to a gateway and send email.

At the same time I was hearing from the Philadelphia County ARES Coordinator, Cliff Hotchkiss, KC3PGT, that both the ARRL and American Red Cross were focusing on Winlink as the preferred means of passing traffic in the event of an emergency. George Miller, W3GWM, the ARRL Eastern Pennsylvania (EPA) Section Manager, also had sent out a note confirming the ARRL requirement for Winlink usage in emergency communication (EmComm) [September 25, 2021 email to all EPA Emergency Coordinators].

Just as I thought I'd reached a dead-end I found a new direction from a fellow ham. As Field Day was wrapping up Jim Fisher, AJ3DI, suggested I consider standing up a 2-m RMS (Radio Message Server) Winlink Gateway. I was off and running. In this article I describe and show the work that went into bringing the idea of an RMS Winlink gateway to fruition.

What is an "RMS Winlink Gateway"?

I met John Galvin, N5TIM, through

the Winlink email group [1] and he offered a draft of his "Using Winlink ... Configurations for Basic, Field and Emergency Communications Use with Diagrams" [2]. This invaluable guide helped me understand what I'd been reading about Winlink on the winlink.org authoritative website. It also helped me focus on what I was going to accomplish in the simple diagram illustrating an RMS Packet Gateway.

As with many projects I've undertaken in my career, this one started out with the idea and followed an incremental and iterative process to get to the final result of a working RMS Winlink Gateway. In what follows, I share a more structured process than actually occurred. My process was by turns fun, frustrating, fruitful, fulfilling and more expensive than necessary. By sharing the distillation of the work I undertook between early July and early December 2021, I hope you'll recognize the value of planning and documenting any ham radio project that requires more than a few minutes or hours of effort on one day.

Start by getting a notebook and pencil and dating your notes and ideas. You'll want to address at least the following components:

- Location – Where will you site the station and the antenna? Considerations include availability of power, connectivity to the house network and internet, spouse/partner approval of gear location and antenna appearance and location.
- RF Chain – A dedicated antenna, feed line, and radio are required for the RMS

Gateway. The radio must have either a built-in soundcard or a 6-pin mini-DIN or alternate (DE-9 as on Alinco single band radios) for connection to an external sound card.

- Power – Sysop guidelines call for dedicated gateway equipment, preferably with automatic emergency power.
- Sound Card – Whether built-in or external, a quality sound card is required.
- Computer, operating system, and network — a 12 V dc mini-pc is sufficient and desirable as it will run off the same power supply and power backup used for the radio.
- Winlink Gateway registration and operating software — Authorization is required to operate as a Winlink Gateway.

In what follows I'll discuss each of these components and describe my choice and reasoning, illustrated by captioned photos.

Location

My shack, located in a corner of what was originally renovated as a home office, is a somewhat cramped arrangement. I was also looking for maximum height for an antenna. After discussions with my wife it was plain that she thought that anything behind the barn was preferable to anything at or close to the house. The back of the barn is the highest ground point on our property at 305 feet above sea level. There's power, 50 A split phase, but no network. I'll address both of these factors. The peak of the barn's metal roof is at ~20 feet and

the peak runs approximately north-south. Inside the barn there was plenty of room to set up an operating position and install networking, power management, computer and communications equipment. This left me with the challenge of installing networking, but the tradeoff for the high point on the property seemed worthwhile. My friend, Clemens Sippel, a talented contractor, finish carpenter and former stage technical director with rigging experience suggested that an Ikea kitchen cabinet (40" H by 36" W by 14.75" D) could be mounted to the inside barn wall to provide shelves and an enclosure around the operating point. By leaving off the back of the cabinet during assembly and screwing 1 by 1 wood strips to the barn wall at the inside dimension of the cabinet, the cabinet could be screwed to the strips and well supported. See **Photo 1** and **Photo 2**.

RF Chain

Looking for a durable and reliable 2-m single-band radio I was repeatedly referred to Kenwood radios as the preferred choice. Recent and current models seemed rather expensive to dedicate to the gateway project.

I came across hamprojects.info [3] while investigating ways of setting up an Allstar node — I'm always looking for my next several projects — and that led to DINAH (DIN connector based Allstar interface for Hams) and that led to N1VG's page [4], which started me on a search for a Kenwood TM-271A single band 2-m radio based on Kenwood's commercial radio line at the time of manufacture. It puts out 60 W at high power and has a big, finned heat sink.

It doesn't have a 6-pin mini-DIN connector.

The European version of the radio, TM-271E, does have a 6-pin mini-DIN socket and what I learned from N1VG is that the TM-271A had solder pads where the connection to a mini-DIN could be made. So

I followed the brief instructions and photos on the N1VG website and successfully installed a pigtail with a 6-pin mini-DIN socket to the radio. The radio has a single menu item to choose 1200 or 9600 bps, and since I'm running VARA FM in wide mode,



Photo 1 — Ikea cabinet houses power connection at the top; vertical ground bus at left, and provides space for the Winlink Gateway Station, backup power and future expansion.



Photo 2 — Detail of cabinet attachment to barn wall.

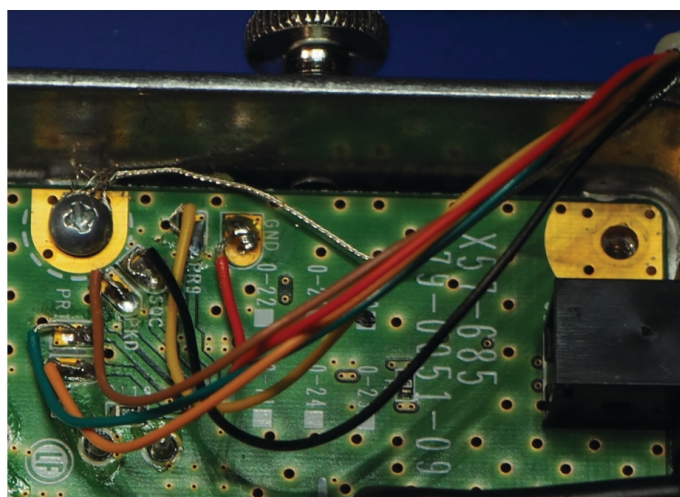


Photo 3 — Radio with the top off showing pads and wiring in place for the 6-pin-mini-DIN pigtail.

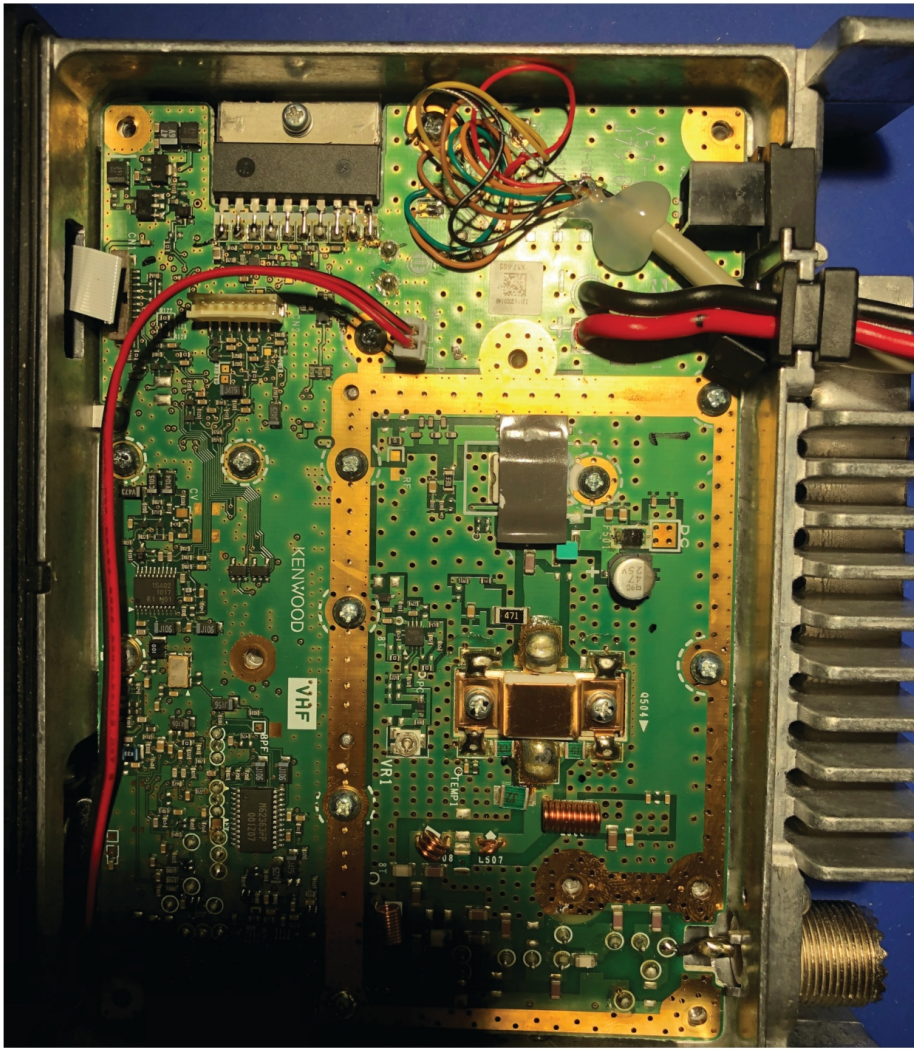


Photo 4 — Hot glue strain relief and wiring in final position just prior to reinstalling the cover.

I set it to 9600. See **Photo 3** and **Photo 4**.

Unbelievably, the QRZ swap meet forum came through the next day with a radio that reportedly had been boxed or sitting on a bench for most of the past decade. It was inexpensive and when received fired up easily putting out the full 60 W. I've since acquired, and modified, a second identical radio for warm backup courtesy of Barry Feierman, K3EUI, who was fund raising for Philadelphia ARES by deaccessioning old radios in return for a donation.

For the feed line, I used LMR-400 Ultraflex terminated with a Type-N connector at the antenna and a PL-259 for the Morgan M-303U coaxial lightning arrestor. The arrestor is mounted inside a KF7P MetalWerks [5] entrance panel box attached to an eight-foot ground rod that could not be sunk beyond 3 feet. So my friend, Clemens, dug an 8-foot long ditch about 18-inches deep and we laid the ground rod down in it. Deeper is better, but better

and best can't always happen.

To get the feed line and ethernet cable from the mast mounted network station transceiver to the operating point inside the barn Clemens drilled a hole for the 2-inch conduit from the back of the entrance panel box into the barn. The conduit carries the bonded station grounding bus out to the entrance panel. The mast is also bonded to the entrance panel with 2-inch copper strap. See **Photo 5** and **Photo 6**. This medium size box can support future expansion to an HF RMS gateway and a remote wideband SDR and discone antenna.

I installed a Diamond X510HNA antenna mounted on a Rohn 50-foot (really 43.5-foot) tall push-up mast as suggested by Bill Popovik, W3AOK. The mast is bracketed to the barn at 5.5-feet and 16-feet above the ground and sits on an 8-inch square plate. The mast is bonded to the entrance panel with 2-inch copper strap. Steve Hoch, WU3I, led the crew that included Cliff



Photo 5 — 2+ inch hole for conduit.

Hotchkiss, KC3PGT, Clemens and me who together installed the mast and antenna. Also mounted to the mast, about 5 feet above the roofline was the station end dish for the Ubiquiti Building Bridge (UBB), which brings the house network out to the barn. The UBB ethernet connection is bonded to the mast where it is mounted. See **Photo 7**, **Photo 8** and **Photo 9**.

Power

Power in the barn was available at a panel in a space about 30-feet from where the antenna mast stands on the outside rear. Using 12-gauge BX armored cable I brought 120 V ac to the planned operating point on a dedicated 20 A circuit breaker. I had acquired an Alinco DM 330-MV switching power supply that would easily power the radio (13 A) and mini-pc (2 A) with headroom to spare.

I planned on using a 12 V battery for backup power, but wasn't sure how to manage the switching until a post-net QSO with Frank Rocap, N3FLL, that had been provoked by Jim Fisher, AJ3DI, talking about his Chinese copy of the device Frank described. Frank used a West Mountain Radio Epic PwrGate [6] to seamlessly switch power (up to 40 A) from ac powered supply to battery backup. That power management device, a 100 A Lithium Iron Phosphate (LiFePO4) battery from Ampere Time, and an Anderson Powerpole equipped electrically fused network controllable power-distribution panel completed the

power setup. With the network controllable power a radio locked in transmit can be powered down without going on site. See **Photo 10**.

Sound Card

I built a Masters Communication DRA-70 from a kit although it's also available pre-assembled and tested. Kevin Custer, W3KKC, of Masters Communications offered his encouragement and availability to solve any problem I confronted while building the kit. The DRA-70 worked though it has since been replaced by a DRA-50 because VOX isn't required with Winlink running Vara FM and UZ7HO Soundmodem. The DRA-50 is the sound card in use for this gateway station running VARA FM in wide mode at 9600 bps and UZ7HO Soundmodem 1200 bps packet. See **Photo 11**.

Computer, Operating System and Network

I sought out 12 V dc powered computers and came across the Chuwi HeroBox running an Intel "Gemini Lake" Celeron N4100, 8 GB of DDR4 RAM, and a 180 GB Intel SSD. This seemed to be plenty of power to run Winlink sysop software and TeamViewer, the preferred tool the moderators of the Winlink Google group use to support users. It has also run UZ7HO Soundmodem [7] for the 1200 bps packet Winlink gateway that shares the radio and computer. For those inclined toward experimentation and who are comfortable with minimal support, PiGate [8] offers an alternate RMS server.

The computer I acquired came with Windows 10 Home edition, and that's sufficient for the purpose. However, because I wanted to use Microsoft Remote Desktop (RDP) to connect to the computer in the barn

from my office/ham shack computer I chose to upgrade to Windows 10 Professional. This was an unnecessary and time wasting exercise. TeamViewer has been more than sufficient for remote access and has no cost for private use on one computer at a time. For users who might need to use RDP for other reasons, purportedly RDP Wrapper Library [9] allows that use with Windows 10 Home edition. I have not tested that.



Photo 6 — Entrance panel box with coax lightning arrestor, ethernet from UBB to switch and tinned copper braid from station ground bar.



Photo 7 — "Antenna up!" For the first time.



Photo 8 — “Antenna going down” two weeks later.



Photo 9 — “Antenna back up” two hours later. The narrow barn hadn’t allowed for enough spread for three point guys, so a fourth point at an approximately right angle to the barn peak trued up the mast.



Photo 10 — Epic PwrGate charges the battery and seamlessly powers the system if grid power is lost.

Getting network access from the house to the barn was relatively easy if a bit pricey. My house network is built upon the Ubiquiti Unifi system. The Ubiquiti Building Bridge (UBB) was readily available and after getting through an 18-inch-thick stone wall to get the cable outside and updating the firmware on both 6-inch diameter dish equipped 60 GHz transceivers the connection to the barn was installed. Tip: update software while both dishes are on your bench. An eight-port switch supporting power over ethernet (PoE) and a PoE powered access point completed the installation in the barn. This supports direct connection over ethernet for the computer, the West Mountain Radio Rigrunner 4005i [10] wireless connection for family and visitors in the area of the barn and connections for the two floodlight cameras I installed front and rear on the barn. See **Photo 12**.

My house network is served primarily by Verizon Fios, but in preparation for the project and in the interest of reliability, I had Comcast internet installed for fail-over support. The house network is configured with PoE for the access points, and the entire network is powered from the transfer switch panel providing grid power or natural gas fired 20 kW generator power that the previous owners installed.

Winlink Gateway Registration, Operating Software and Operating Frequency

I had registered with Winlink early in 2021 and had sent messages both for testing purposes and in response to the EmComm Technical Group's weekly Winlink Thursday exercises. Registration as a gateway required evidence of prior use of Winlink and agreement to the "Sysop Guidelines" [11], [12] which contains recipes and advice for configuring Winlink Express (client) software on many different radios and sound cards. It also — in conjunction with the help files in the three main Winlink Sysop programs (RMS Packet, RMS Relay, and RMS Trimode) — offers plenty of information for configuring a Winlink gateway. The details are mostly there, supplemented by excellent support by the list owners/moderators of the Winlink programs group [13].

Historically, Winlink gateways supported connections using a variety of ham radio digital modes. Likely packet and Pactor are among the best known and most widely

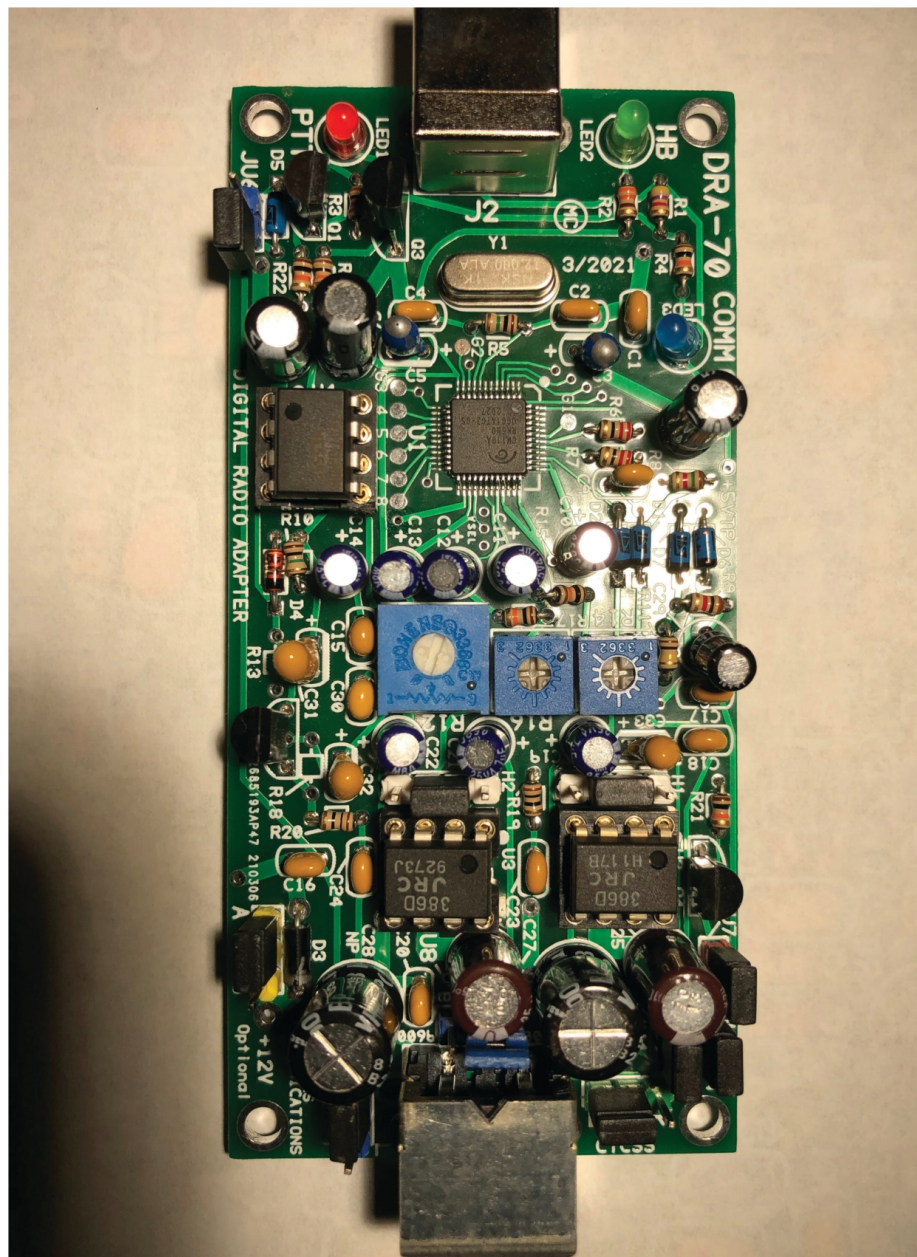


Photo 11 — DRA-70 completed, includes USB type B port connection for computer and a 6-pin mini-DIN connection.



Photo 12 — Transceiver dish and ethernet lightning arrestor on the house.

used though the Winlink folks themselves support Windmor (now deprecated) and Ardop. Of late, VARA FM on VHF and VARA HF, software modems [14] from José Alberto Nieto Ros, EA5HVK, have become widely used. I implemented VARA FM at 9600 bps in Wide mode and 1200 bps packet. RMS Packet Dual-Mode (Packet and Vara FM) setup using a single radio and sound card by Scott Curie, NS7C, [15] was an invaluable aid in setting up and configuring the sysop software. Scott came through when contacted directly by email with critical troubleshooting assistance. Also useful was a packet centric document I found [16]. Both of these documents come from the Winlink site, a rich resource.

The last step was picking a frequency for operation. I relied upon the Area Repeater Coordinating Council Band Plan [17] for 2-m and selected the sub-band of 145.510 – 145.790 MHz reserved to digital and experimental modes (20 kHz spacing) by the ARCC band plan despite the regular appearance of FM analog QSOs on this and adjacent frequencies. K3FZT-10 is now on the air and serving hams throughout the Delaware Valley at 145.670 MHz. See **Photo 13**.



Photo 13 — The completed station with room for storage and expansion.

Acknowledgements

I've mentioned many hams and vendors in the text, but particularly want to acknowledge my friend Clemens Sippel a craftsperson, rigger and problem solver nonpareil. In addition to general encouragement Cliff Hotchkiss, KC3PGT, Philadelphia County ARES Coordinator, helped put up the antenna. Jay Silber, WA2UAR, helped test the gateway and provoked me to do a better job adjusting the audio levels. Perry Pepper, KC3JUD, helped test the gateway. Along with me, these three Yaesu FT-991A owners all suffered through our learning curve of digital sound card modes under the tutelage and with the encouragement of Barry Feerman, K3EUI. Ron Wenig, NY3J, and Glenn Allison, N3MEL, provided a wide range of advice particularly for UZ7HO Soundmodem packet implementation. Daniel Wagaman, W4GMN, editor of the Phil-Mont Mobile Radio Club newsletter *The Blurb* reviewed, commented upon and generally assisted the improvement of the manuscript. "It takes the whole community."

Steven J. Davidson ("Steve"), K3FZT, holds an Amateur Extra class license. He was first licensed as KN3FZT, then K3FZT at age 13 in January 1964 after a Novice and Technician class given at the Franklin Institute in Philadelphia, and co-sponsored and taught by then Philmont Mobile Radio Club (PMRC) members. Now he's a PMRC member. A retired emergency physician and medical informaticist and former Philadelphia Fire Department Medical Director, he naturally gravitated to digital modes and ARES and EmComm. He serves as a VE for both the ARRL and GLARG. In addition to the Winlink Gateway in the barn there's now a WIRES-X node for one of the MARC UHF repeaters and he's building out a packet BBS and gateway for the Mid-Atlantic packet network. AREDN connectivity is in his sights. He prefers projects to operating, but when he operates it's mostly FT8 and rag chews on 160 and 75 m recapitulating the late nights when as a youth he listened on his Heathkit shortwave radio to many an old timer. He also operates the digital voice modes of DMR and Fusion/WIRES-X and maintains an Allstar node.

Notes

[1] <https://groups.google.com/g/winlink-programs-group/about>.

- [2] https://www.qsl.net/n5tim/DOCS/Winlink_Configs_2021_V2.pdf.
- [3] <https://hamprojects.info/>.
- [4] <http://n1vg.net/>.
- [5] <https://www.kf7p.com/KF7P/EntrancePanels.html>.
- [6] http://www.westmountainradio.com/product_info.php?products_id=epic-pwrgate.
- [7] <http://uz7.ho.ua/packetradio.htm>.
- [8] <http://www.pigate.net/>.
- [9] <https://github.com/stascorp/rdpwrap/blob/master/README.md>.
- [10] http://www.westmountainradio.com/product_info.php?products_id=rr_4005i.
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- [12] https://winlink.org/content/winlink_book_knowledge.
- [13] <https://groups.google.com/g/winlink-programs-group>.
- [14] <https://rosmodem.wordpress.com/>.
- [15] https://www.winlink.org/sites/default/files/RMSE_FORMS/rms_packet_dual_mode_single_radio_setup_0.pdf.
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- [17] http://www.arcc-inc.org/_files/ugd/ed9285_9a3724a1da3b402c88d7825cbd5058dc.pdf.